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ABSTRACT

Designed to assist California community college personnel in implementing 1986 regulations concerning associate degree requirements, this paper analyzes the key terms in the new policy, "college level" and "critical thinking," and discusses practical implications for assessment, curriculum, and instruction. First, the paper identifies factors that can be used to define "college level," including intensity, abstractness, open-endedness, rigor, independence, and type of instructional materials. A chart linking these factors with instructional methods, assignments, and tests is provided. The remainder of the paper focuses on "critical thinking," arguing for a broad definition of the term, encompassing the generation of ideas, decision making, problem solving, and profound thinking. Subsequent sections examine: (1) the appropriateness of a broad definition for educational policy; (2) a programmatic definition of critical thinking skills as those diverse cognitive processes and associated attitudes critical to intelligent actions in diverse situations and fields that can be improved by instruction or conscious effort; (3) the cognitive processes that do not constitute critical thinking (e.g., innate or instinctive processes) and learning activities that do not require these skills (e.g., short answer quizzes or rote drills); (4) holistic assessment of competencies; (5) learning objectives; (6) the impact of critical thinking requirements on programs and enrollments; (7) curriculum planning; and (8) course structures. The next sections of the paper describe a process-oriented method for teaching critical thinking, discuss coaching techniques that support skill development, and underscore the importance of planning for transfer and commitment to the process. Finally, a chart is presented which identifies the components of intelligent acts and related generic and domain-specific thinking skills and attitudes. (AJL)

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PUBLIC POLICY AND EDUCATIONAL REFORM

by

Nancy Clover Glock, Ed.D.

1987

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"COLLEGE LEVEL" and "CRITICAL THINKING": PUBLIC POLICY AND EDUCATIONAL REFORM

by
Nancy Clover Glock, Ed.D.*

In 1986, the Board of Governors of the California Community Colleges instituted a policy defining college level and permitting only courses that meet the conditions of this definition to be counted toward the degree. This policy brought to culmination three years of effort from faculty and administrators in California's 106 community colleges to reestablish the credibility of the Associate Degree.

Key phrases in this policy are the "ability to think critically" and "to understand and apply concepts at a level determined by the curriculum committee to be 'college level'"; and "college level learning skills and vocabulary". This essay is an effort to analyze the terms "college level" and "critical thinking", as they relate to this new policy, and to develop some of the practical implications of this analysis for assessment, curriculum, and instruction in community colleges.

"COLLEGE LEVEL"

Important as the term"college level" is in determining what work should be counted toward a college degree, it is not an easy concept to define without circularity. Defining it is less a matter of stating an exhaustive set of criteria, than of stating explicitly what are the relevant factors. Since most subjects can be taught in some form to most ages, content alone is often not a sufficient basis for determining college level, nor is the calculated "grade level" of required texts. Nevertheless, it is possible to discern several factors that are typically used to judge the difficulty or "level" of curricula, as for example when an introductory economics course for high school is distinguished from a course for non-majors in college and both from a course appropriate for majors. Unfortunately, none of these factors, much less how they are to be combined, can be readily reduced to a rule. Weighing them is a matter of judgment, with the clearest cases at the extremes and much room for legitimate debate in the middle.

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On the next two pages, a number of these key factors are summarized (in Table I.) Each of these factors is best viewed as a continuum running from clearly "pre-college" level to clearly "upper division or graduate level." *The point of this table, it is important to note, is not prescriptive but descriptive.* It is meant to describe what we do in fact take into account in determining college level, not to recommend what we ought to take into account--much less what we ought to teach. Not all of these factors are equally appropriate to all college classes, much less necessary to all of them. Nor are these factors limited to college classes. The educational merits of these factors and their appropriateness for different situations must be judged case by case.

In practice, these factors seem to compensate for each other so that a course regarded as "low" in one factor (i.e. towards the pre-collegiate level in one factor) may still be regarded as "college level" if it is "high" in another, as long as it is strong in at least one qualitative area. (That is, quantity of coverage alone is not ordinarily regarded as justifying "college level" if all of the qualitative factors are pre-collegiate.)

CT **Critical Thinking:** Aspects of a course essential to its cultivation

T **Transfer:** Essential for courses that are to support upper division or graduate studies (Courses designed for students who intend to complete their higher education at the end of two years do not need to stress these characteristics)

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FACTORS COMMONLY USED TO DETERMINE COLLEGE LEVEL

	SYLLABUS/METHODS	ASSIGNMENTS/TESTS
Intensity * Diversity: *Greater range of different but related topics covered* * Depth: *More complex points made regarding each topic* * Amount: *More new topics covered per class or per course*	College courses in foreign languages cover twice as much per semester; College level history delves into conflicting interpretations.	College homework load is 2-4 times that in high school.
Abstractness *Conceptual: *Definition of concepts primarily by reference to other concepts or to symbols; tables; formuli (though examples are offered for purposes of illustration). Emphasis upon manipulation of symbols, and concepts.* T *Theoretical: *Emphasis upon concepts and relationships of concepts rather than upon applications; stress upon mastery of a "discipline", with its distinctive concepts, methods, and standards, as well as upon acquisition of the information to be harvested from that discipline. Objective is partly to provide a foundation for further academic work.* T *Principles : *While rules of thumb and "recipes" are available, principles are the main focus, thus providing more leverage on the future, more flexibility. Objective is the capacity to adapt to many situations, rather than to prepare intensely for only a few (hence it is "education" not just "training")*	Course outlines may well start with problems and applications intended to suggest the relevance of theory, but will move quickly to a systematic presentation of central principles. Methods and inquiry strategies distinctive to the discipline are explicitly discussed, or alternative practices or problem-solving techniques presented and assessed. Evidence or reasons are offered in support of at least some of the information presented. Criticisms and conflicting viewpoints are discussed. **CT**	Students are asked not only to find out, describe, list and summarize facts and theories, but to compare or assess theories, make their own observations, develop original analyses, syntheses or arguments. In lower division, these activities may be carried out at a very simple level or on elementary material in order to introduce the techniques. In vocational work, students are required to handle difficult situations, or to solve problems requiring selection from among, and intelligent application of, relevant principles. **CT**
Open-endedness *Indeterminateness: *Multiplicity of acceptable answers, some more or less "effective" (see "Standards" below), but there is no one correct answer. Or, if only one correct answer is possible, a multiplicity of strategies or solutions for arriving at that answer exists or the one correct strategy cannot be readily determined. Unexpected but acceptable answers or results are possible; generation of new ideas is rewarded.* CT *Process: *Emphasis for instruction and assessment is as much upon the generation and selection of various strategies for completing assignments & tests as it is upon the correctness of the knowledge, the effectiveness of the communications, solutions, products, or performance itself. Trial and error is encouraged; explicit attention to process may be stressed.* CT	Course outline covers topics but classroom methods allow for emergent possibilities. Plans for classes and assignments are not fully determined. Faculty have wide latitude to respond to new possibilities, while meeting course objectives. Faculty can admit to being "wrong"and are prepared to change their views in response to in-class dialogue.	Work requires judgement by students. Written tests involve essays rather than short answers. Computation, performance, or problem-solving is assessed not only on the final answer but upon the method or strategy used to achieve it . "Hands-on" work is observed in process and the process appraised. Problems posed (in an auto shop class for example) would include some for which the answers were not obvious. Risk-taking is rewarded.

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	SYLLABUS/METHODS	ASSIGNMENTS/TESTS
Rigor *Standards: CT *Are shared by, or define, a discipline or state of the art, and faculty and students are accountable to these shared understandings. The "effectiveness' of answers (see "Indeterminateness" above) is judged by reference to these shared standards. (Students have mastered this discipline, or field, or occupation only to the extent that they have mastered these standards.)* *Judgement: CT *Since those evaluating work are accountable to these standards, evaluations of work are not merely "subjective", reflecting personal preference, even though they are not objective in the way an "objective" test is intended to be . Professional judgement must be employed in assessing answers or completed work against multiple criteria and/or "globally", as essays or Olympic events are judged.* *Competence: *Grades indicate a level of mastery, rather than effort or improvement.*	Excellent information is available in community service courses or on public television or contemporary K-12 text-books. The difference between these "levels" of education and an appropriately demanding high school or post-secondary course lies in the extent to which the latter requires students not only to "know" such information, but to understand the sources and the significance of that information. Instructors model the methods they expect and elicit insight by the kinds of questions they ask.	Essays, research papers, and other complex products or performances are intended to show one or more o the following: a) Ability to recognize and define problems, or to under-stand or pose good questions b) Knowledge or the ability to obtain the information or resources necessary c) Appreciation of what is at stake, of standards, objectives d) Awareness of at least the obvious alternatives or ability to generate creative solutions e)Decisions or conclusions, based upon a-d, that are at least plausible or defensible.
Independence *Explanation: *Material is presented with relatively little effort to relate it to student experiences, provide concrete examples, spell out step by step instuctions, or lay out options.* *Timeframes: *Work is assigned over longer periods of time with as much as an entire semester passing before anything is required; complex assignments may be made with no information as to how they are to be broken down into manageable tasks* *Coaching: *Monitoring of student effort is slight or non-existent; relatively little time is spent giving answers, assessing student work, analysing solutions, or explaining mistakes.*	Traditionally, the "higher" the course the more students are left on their own to understand what they are being taught, and to complete their own work. Quality of instruc-tion is judged upon the instructor's grasp of the subject and its stand-ards. (Yet, where instructional quality is judged upon "teaching method" as well as know-ledge, and the instructor provides connections, explanations, sugges-tions, and frequent feedback--all aspects of good instruction--the "college level" is not necessarily lowered thereby)	Assignments that require students to define problems for themselves, organize their own tasks, generate strategies and find informationThe ability to work independently not only is a requirement of post-secondary education, but it is an expectation that employers and others have of people who have completed a post-secondary degree. Such independence must therefore be demonstrated successfully at some point before a degree is granted.
Materials *Primary Sources: *Textbooks are supplemented or replaced by works and commentaries not written primarily for students* *Reading Level: *Vocabulary and sentence length make greater demands of the reader as indicated by the calculated "grade level"* *Diversity: *Students are expected to comfortably find and use many sources of information*	Instructing students in effective approaches to difficult material does not compromise the level of the course.·	Textbooks do much of the intellectual work for students; courses that require students to do this work for themselves by reading primary sources are "higher" level.

"CRITICAL THINKING"

The new regulations governing which courses can count toward an associate degree in California do not only require that the course be college level; they also mandate that the course "require the ability to think critically". That is not to say that they require faculty to teach or even to test critical thinking skills as such, but rather that they require faculty to assign work difficult enough to challenge, cultivate, and demonstrate critical thinking skills appropriate to each of the fields for which degree credit is sought.

The purpose of this requirement is to assure the continued credibility of the associate degree. Since it is generally assumed that possession of a college degree, including a two-year degree, attests to the ability of its holder to "think critically" in a number of areas, to graduate students from community college who are unable to do so perpetrates a fraud on both the public and the students. To require as a condition of college graduation that students succeed in coursework that requires critical thinking is, therefore, a matter of integrity.

The new regulations can thus hardly be regarded as unreasonable. At the same time, they could turn out to be highly disruptive. If 'critical thinking' is interpreted too narrowly, the requirement that only courses difficult enough to demand such skills can be counted toward the associate degree could eliminate entire programs and decimate enrollments.

Narrow vs. Broad Definition

Traditionally, 'critical thinking' has been defined narrowly. It has meant something like "evaluating (reasons and conclusions) on the basis of explicit, valid criteria". The roots of this definition trace back to the "forms of thought" first analyzed by Aristotle, then taught as rhetoric and logic in the medieval quadrivium, and today universally required in English composition classes or taught in informal logic classes, usually somewhere supplemented by "scientific method" or inductive reasoning. In this tradition, *"critical"*" thinking is critical in the sense of leveling criticism.

More recently, however, the term has come to be defined broadly enough to encompass not only the leveling of criticism, but also the generating of ideas, the making of decisions, the solving of problems, and the thinking of profound thoughts. And with this broad meaning it has shown up in one after another recommendation for the improvement of education. The meaning of the term has thus gradually stretched to cover essentially all of the areas where "thinking" is at stake in education. Indeed, in this public discourse, the words themselves seen to have been changing, with 'critical', 'thinking', and 'skill' each expanding in its own way. Thus, *"critical"* in at least some recent instances seems to mean

"crucial" or "essental", so that 'critical thinking skills' comes not to mean the "thinking skills used to critically evaluate something", but the *"thinking skills that are critical to the accomplishment of something"* . An indication that something like this shift in meaning has occurred is that people who in one context will contrast 'critical thinking' with 'creative thinking', will in another context use the same term, 'critical thinking', to encompass creative thinking. *Thinking*' has been similarly extended, coming to cover not only verbal thinking, but also visualization, intuition, and action itself. *'Skills'*, finally, has also broadened to include not only the skills *per se* , but also the disposition to use these skills and the values and attitudes that make a truly "critical thinker". (See for example the work of Richard Paul.) Thus when the public demands improvement in "critical thinking skills" it is demanding not only, or even primarily, training in logic, but rather training in those skills of visualization and verbalization critical for success in most endeavors--as well as cultivation of the disposition to use these skills.

Meanwhile in the effort to keep such a key notion from getting entirely out of hand, many theorists have fallen back upon the narrower traditional notion, seeking to clarify the term by reference to concepts drawn essentially from informal logic or from the rhetorical forms. (See for example the recent work of Robert Ennis where the concept of "critical thinking" is related to the broad notion of decision-making, but the actual skills listed are primarily logical and epistemological). Such definitions because they are narrow can be more precisely applied, and because they are traditional can be more readily understood and convincingly defended among educators.

Why a Broad Definition is More Appropriate for Educational Policy

The impetus for incorporating "critical thinking skills" into education is coming as much from the public as from educators themselves. Indeed, it is at the behest of this public that policymakers have required competency in "critical thinking" from students graduating from K-12 and from publicly supported postsecondary institutions. And it is at their behest that such efforts are funded. It is important, therefore, that in carrying out this mandate to teach "critical thinking", educators prepare to teach what the public intended by that term--or at least that they do so insofar as that is feasible and not at odds with the overall goals of education for which educators are ultimately accountable.

What "the public" wants, of course, is hardly a consistent, much less an entirely clear notion. Nonetheless, in reports by business groups and in magazine and newspaper articles, as well as in testimony to legislators, etc., citizens who are urging more "critical thinking" do not seem to have in mind only the ability to comprehend and to analyze textual

material, important as that is. Their concern, that is, is not only with the ability to "discern the truth", but also with the ability to "think on one's feet", to "show intiative", and to "solve problems." From their perspective, typists who notice incomprehensible statements in what they are typing and seek out the author to find out what was meant are "thinking critically". The skills at stake for the public are partly nonverbal, as much the hands-on skills of an auto mechanic trying to figure out an unfamiliar problem as the word skills of a debater trying to make a point. Nor is their concern only for ability; it is also for character--for "initiative", "honesty", "accountability", "objectivity", "integrity" and "service". The public has thus been at pains to urge not only the intellectual skills necessary for economic survival in the world of high technology, but the moral qualities as well.

To attempt to meet this public concern with courses in informal logic is to partly misread that concern. That concern is not to impart some new set of skills, however valuable, but to engender more skillful, more alert, more intelligent ways of doing all manner of things. Of course, instruction in informal logic if taught with a view to multiple practical applications and ready transfer might be an effective way to accomplish this end. But still it is not instruction in "critical thinking" or in logic or in English composition, per se, that the public is calling for. What they are seeking is a different approach to most subjects and occupations. Where "critical thinking" is treated as a separate subject, then, it will meet the public's concern only insofar as it strengthens performance in other subjects.

It is a broad view of "critical thinking", therefore, that best reflects the public interest in the matter and thus ought to govern the interpretation of the term when it is written into public policy. Such a broad definition, moreover, would not only meet the concerns of the public, but it would also better accomodate the diverse needs of students who seek success not only in the liberal arts and sciences but also in the arts and vocations.

A broad view has also the virtue of being less elitist since it acknowledges the intellectual significance of what people do who work less with words and more with their hands.

Finally, a broad interpretation of "critical thinking" best accomodates the rapidly developing field of cognitive theory. Without pre-judging which are "higher" or "lower" skills, or assuming that something like formal logic is at the heart of effective decision-making, it remains open to whatever may be found out as to how we actually process information and arrive at sound decisions. A broad definition of "critical thinking", can accommodate the "right-brained", "constructive" or "creative" aspects of thinking as well as the "left-brained". It could thus acknowledge the close partnership between cognitive processes that are intuitive, insight-producing and non-verbal (i.e. in the "context of

discovery" where alternatives are generated) and cognitive processes that are critical, sceptical, systematic, analytic and verbally oriented (i.e. in the "context of verification" where alternatives are evaluated.)

On the other hand, a definition that is too broad would be useless. And, certainly, the term "critical thinking" is at risk for such detioration. In the backlash to the back-to-the-basics movement, it has has suffered from its popularity, being the catch-phrase of every recommendation for educational reform. Scholars whose disciplines each have their own brand of "critical thinking" and who have embraced the concept and welcomed the strong public interest have nonetheless expressed skepticism, fearing creation of yet another buzz-word, another distracting panacea. Specifically such commentators have suspected that it is only the vagueness of the term that has earned "critical thinking" such universal support by promising effectiveness to everyone but nowhere so clearly that claims on its behalf may be tested and the success--or failure--of efforts to strengthen it conclusively determined.

The question is, then, *can a responsible definition be found that incorporates a view of critical thinking broad enough to account for wide ranging public concerns without simply yielding to vagueness: a definition at once comprehensive and clear.*

Critical Thinking in the Broad Sense: A Programmatic Definition

The most common way to define "critical thinking" is to propose an (exhaustive) list of the skills themselves. As the concept broadens, however, such an approach becomes unworkable. What is needed instead is an explication of the characteristics which any skill, or accomplishment, must have if it is to be an instance of "critical thinking". The following definition is of that kind. It delineates at least some of the charactistics necessary to "critical thinking", especially those characteristics of most relevance for educators. It is what Israel Scheffler (in the Language of Education) has termed a "programmatic definition" in that it does not simply describe how we use the word, but takes into account what the practical implications would be of choosing one definition over another. While it does not purport to exhaust the relevant characteristics of critical thinking that could be specified, the characteristics it does specify have been selected to do justice to the current meanings of the term, while providing primarily for educational policy, instruction, and assessment.

DEFINITION: "Critical thinking skills" are (a) those diverse cognitive processes and associated attitudes, (b) critical to intelligent action, (c) in diverse situations and fields, (d) that can be improved by instruction or conscious effort.

Comments

(a) No one "skill" is "critical thinking". The term actually encompasses a diverse set of distinct cognitive processes not all of which are necessary to any given action.

(b) "Intelligent action" is any act of comprehension, communication, or problem-solving that admits of various acceptable solutions or strategies. These solutions or strategies are not usually "right" or "wrong" but are "better" or "worse" as assessed against multiple criteria (such as completeness, coherence, clarity, economy of effort, elegance of proof, or excellence of workmanship). Where only one solution is correct and only one strategy will work (as with a puzzle), solving the problem is an "intelligent action" only if the person must find that strategy on his own.

"Intelligent action" refers not only to verbal and analytical actions but to sequences of kinesthetic actions such as participating in a tennis match or repairing an engine--as long as these actions can be subjected to analysis and the effectiveness of the approach or the strategy assessed. ***Intelligent actions require not only critical thinking skills of the "generic" sort encompassed by the definition, but also the dispositions to use these skills, domain-specific knowledge, and some innate capacities as well.***

(c) These skills are useful in diverse situations and fields in that they are ***equally fundamental to most fields of endeavor.*** *Once learned in one environment, and under the right conditions, they can be transferred into another. They will not, of course, be sufficient for success in the new domain, since specific knowledge of the domain in question is always necessary as well. Instead, in the new environment, they will be applied on a trial and error basis, serving at first only to speed up the learning process in the new domain. Thus if effectively transferred, critical thinking skills substantially decrease the amount of time necessary to become proficient in a new field or endeavor, hence their "generic"--or better--their "generative" quality.*

(d) Critical thinking skills are skills and as such can be improved by instruction and conscious effort, i.e. they are teachable and improvable. As in any endeavor, of course, innate ability also contributes such that there will always remain differences in competence between individuals which cannot be eradicated with even the keenest motivation and the most effective coaching. As neurolinguistic and related research progresses such limits to the feasibility for instruction will no doubt be clarified. Nonetheless, much of the thrust of discovery in this area so far has been to further expand rather than to restrict our notion of what it is possible to teach people. In any

case, it is true by definition that a skill encompasses only those processes which can be taught or which can be improved by teaching and is thus the proper locus of educational policy and effort.

What 'Critical Thinking' Is Not

While the definition proposed here is comprehensive, it is not vague or all-encompassing because there are cognitive processes that do not constitute critical thinking on even the broadest interpretation of that term. Cognitive processes to be "critical" must be teachable and cannot therefore be innate or instinctive processes alone, complex as these may be. "Critical" cognitive processes must also be transferable:

> **...[T]he concept of...a set of learning strategies applicable over a significant range of inquiries, belongs clearly to that of basic skills, enhancing the effectiveness of decisions to learn. Without guaranteeing the capture of new truths at will, [these strategies] increase potential...that is, such [they] increase the agent's capability to learn, strengthening the likelihood of his learning what he indeed sets himself to learn.**
> **(p. 89, Of Human Potential by Israel Scheffler)**

Finally, they must be distinctively associated with "intelligent actions." This last requirement means that critical thinking in the full sense is not at stake (or is but minimally involved) in any response required of a student that is fully determined, i.e.for which there is but one or a small set of correct answers and only one way to arrive at this, or these, answer(s). Short answer quizzes, essays that ask respondents "to list" or "to describe" what has already been listed, or described in class, or problem sets where decision procedures are given, applications of given formulae where the terms of the problem are fully laid out, and the following of recipes, instructions, or other skill demonstrations that require execution of a fixed series of motions or rote drills are not "intelligent actions" in the required sense.

(This is not to say that such activities are not without their difficulty or their value, but only that such activities do not involve the critical thinking of contemporary concern in education. Nor, especially, is it to say, as Bloom's Taxonomy has been interpreted as saying, that "describing" is a "lower" activity that does not involve critical thinking. Where the act of description requires original selection and ordering it is as demanding as any intellectual activity, and a good test of the understanding of a theory. It is only where the request for a description is not a request for selection and judgement, as is too often the case in classwork, but a request for what is sometimes disparaged as "regurgitation" that the cognitive activity involved in describing something fails to tap critical thinking.)

On the other hand, actions involving physical skill that are not only habitual but that embody instantaneous decision making, such as some instances of athletics or craft, do call upon critical thinking, at least in the broad sense defined here. The test is whether the series of

actions can later be analysed and assessed for strategic or aesthetic effectiveness and improved thereby.

On the definition proposed here, interestingly enough, answers to questions of logic, mathematics, computer programming or Latin--even answers to 'objective" critical thinking tests--that require only the step-by-step application of known rules, and admit of only one correct answer, would not in and of themselves constitute critical thinking, even though the practice of such activities might well cultivate the patience and train the discriminations that critical thinking requires.

> **Basic skills have, in some educational discussions, been contrasted with 'creative thinking'. What sort of contrast might be involved? Consider reading again. The reader may learn something new to himself in reading a library book, but he has not therefore processed the message critically nor has he engaged in creative inquiry–inquiry beyond the application of set rules. Wielding an algorithm in arithmetic is not the same as mathematical problem-solving, which admits of no decision procedure, i.e. a routine guaranteed to yield the solution.**
>
> **(p. 87, Of Human Potential by Israel Scheffler)**

Of course, as when one uses a "truth table" in a logic course, understanding an algorithm or step-by-step process in the first place, appreciating its significance, and--especially--judging when it's appropriate to use that procedure are very much matters of critical thinking.

Setting of "Critical Thinking" Objectives and the Assessment of Competencies

Assessment

To think critically, one must think about something, and to some end. Thus, how effectively someone thinks can only be determined in connection with intelligent actions carried out in some actual situations. To assess someone's ability to thinking critically, then, we must set up situations and analyse that person's response. More specifically we must:

1. Set tasks (or observe events) that call for such intelligent actions as the

Comprehension and appraisal of an argument
Presentation of an explanation, evaluation, definition, or argument (etc.) informally in a discussion or formally in a speech or essay or report
Solving of a mathematics problem or puzzle for which there are no decision procedures, where there are several solution strategies, or one strategy that must be found by trial and error
Development of a design or the giving of a performance in art or sport which calls for ingenuity, analysis and self-assessment
Competition in a match or contest or debate
Management of a complex situation (e.g. a pack-horse trail leader faced with a situation in which the customers in his charge were at risk; a landscaper given conflicting priorities by customers)
Conducting an open-ended interview, managing a group of children, handling an irate customer, resolving conflicting demands for secretarial services

2. Assess the presentation, performance, process, or product as a whole

3. Analyse the components to determine which specific critical thinking skills, attitudes, or domain-specific knowledge contributed successfully to this whole and which need further development.

In considering the assessment of cognitive skills, it may be helpful to consider the assessment of physical skills. In tennis, for example, we consider a player **good** only if she wins a certain number of matches; in diving, only if his actual dives are typically rated highly by judges. A coach intent upon improving performance does indeed test and analyse the components of the athlete's performance, finds areas in need of improvement, and set practice sessions designed to strengthen that particular skill. Indeed in modern sports, considerable ingenuity and high technology have gone into devising more effective ways of measuring specific skills in order to diagnose various strengths and weaknesses. Yet even so, should an athlete "pass" all of these skills tests with flying colors, she would still not be considered "good" unless she performed well and won often.

Similarly, when the public asks for "critical thinkers", they are not asking for people who test out well on a variety of measures of specific logical or analytical skills. When faculty want students who can think critically they don't mean students who have gotten A's in their "learning skills course". In every case, what they seek are people who can select and use both critical thinking skills along and domain-specific knowledge to successfully carry out various kinds of intelligent actions. It follows, then, that **critical thinking competency can only be assessed in connection with actual applications. Tests of specific critical thinking skills, where valid, can be useful in diagnosing strengths and weaknesses, but not as measures of over-all competency.**

It also follows that even the measurement of specific critical thinking skills is difficult. Objective tests of a particular cognitive skill can be used appropriately to measure an aspect of critical thinking only if open-answer formats are used to supplement the multiple choice answers. These open formats are essential because they permit students to explore and express assumptions, qualifications, misgivings, or other answers not anticipated by the test maker--that is, they permit students to think critically about the test itself!

Setting Objectives:

Given this necessity to assess critical thinking in the context of intelligent action it follows that objectives for courses that are to require critical thinking should not just speak of "demonstrating critical thinking skills" *per se*, or of "problem-solving" *per se*, but should specify the types of intelligent actions that will be required and that will be used as a basis for assessing the ability to think "critically", in context. For example, objectives might require

students to generalize, to be able to *"demonstrate how they would handle certain situations", "demonstrate the conduct of open ended interviews in a variety of situations", "compare , explain, and assess the differences between corporate management styles in different countries."*

Inclusion of such clear objectives is essential not only to assure that the course challenges critical thinking as fully as a college level course should, but also to permit students to perceive from the outset a focus for their efforts to learn how to think critically. The relationship between meeting course objectives, learning how to use critical thinking skills, and the earning of a good grade should be spelled out from the beginning.

Requiring Critical Thinking

Impact on Programs : ***College-Level Subjects***

Those charged with actually implementing the new curriculum reforms find themselves immediately up against a difficult question: Does a close relationship between critical thinking and objectives appropriate a given field naturally exist for all subjects? That is, are all subjects equally well-suited to be "college level" as defined by the new regulations or **are some subject matters ruled out at the outset.?** If one defines critical thinking narrowly, treating it as the essentially verbal activity of analyzing and organizing ideas as these relate to argumentation and the assessment of evidence, then the answer must certainly be "yes". Such a definition would seem to rule out some occupational subjects and performance-based subjects. Of course, curriculum planners might tack on activities such as the critical analysis of argumentation to any course, but setting such peripheral requirements would comply only with the letter of the law, not its spirit.

If, on the other hand, 'critical thinking skills' is defined in the broad terms seemingly intended by the public, as has been done in this paper, and if the intelligent actions implicit in most areas of human endeavor are identified and analysed, most subject matters will turn out to have components that are both central to the subject and definitely critical thinking.

Impact on Enrollments: ***College-Level Students***

The other question that arises in connection with the requirement that only courses that call for critical thinking may count toward the degree is whether they **rule out certain students at the outset.** Under a policy mandating that all college level courses require critical thinking, what happens to the students who lack the skills to do such thinking, at least in connection with college subjects? What happens, that is, to those students who were the object of concern in the first place? Surely, it cannot be the intention of public policies intended to increase the

capacity for critical thought to simply screen out those who lack such abilities and withhold a college degree. Rather it must be their intention that such students should learn these skills.

In establishing the new regulations, California has been sensitive to its obligations. It has, to begin with, recognized that the more rigorous standards would preclude success in degree applicable courses for a great many of the students the community colleges have traditionally served. Accordingly, its Board of Governors has accompanied the new regulations with other requirements for the setting of empirically validated pre-requisites, the extensive assessment of student abilities, and the provision of instruction designed specifically to enable students to strengthen these abilities.

But a key question remains: when it comes to strengthening critical thinking skills, what mode of delivering instruction is likely to be the most effective and the most feasible?

If students are to learn critical thinking skills, are they best left to pick them up essentially on their own? Or should they be taught such skills in courses designed exclusively for that purpose and by instructors trained primarily in cognitive processing and in related instructional techniques? Or should they learn them from subject-matter specialists who incorporate critical thinking skills instruction into their regular courses?

Curriculum Planning for Critical Thinking: Content-Based vs. Skill-Based Courses

One of the most insistent of the unresolved questions plaguing those who must find practical ways to implement public policy directing educators to assure that students can think critically is whether to attempt to teach critical thinking skills as part of courses in the standard curriculum or to establish courses especially designed for the purpose.

On the one hand, it is obvious that if critical thinking skills are to be exercised in relation to intelligent acts, they must be learned in conjunction with such acts. It is also obvious that at least some specific critical thinking skills, are so deeply embedded in given subject matters that it is simply not feasible to teach them except in, or in close conjunction with, content-based courses. For example, attempts to teach problem-solving techniques divorced from the problems themselves and from their consequences force them to be taught as games or puzzles and risk their trivialization. Skills learned in a vacuum may transfer poorly and may thus never be applied to the very kinds of situations from which they were abstracted in the first place and for which they are meant to be used. Thus, such specific skills as pattern recognition, estimation and strategies for approaching unfamiliar problems--all essential to mathematics--must be taught in close conjunction with the solving of actual mathematics problems, or else their point is lost. Even though these skills can and should be generalized

beyond mathematical application, they must first be grasped in connection with it and then extended to other domain-specific applications, if their full power is to be grasped.

Even subjects traditionally taught separately in skill-based courses, such as writing, may suffer from their isolation. Indeed, the desirability of only teaching these skills in courses devoted exclusively to them has been challenged by the effectiveness of "reading across the curriculum" and "writing across the curriculum" programs. All the more does "critical thinking across the curriculum" seem the right approach, thinking seeming even more inseparable from its products then reading or writing.

At the same time, it is equally obvious that teaching critical thinking skills as such requires techniques--and motivations--that not all teachers primarily trained in subject matter possess. Of course, to those instructors who do possess the interest, technique can be taught. And with techniques in how to incorporate critical thinking skills instruction into content-based courses, some instructors could design courses that would maintain the close relationship between subject matter and thinking skills, while permitting a significant emphasis upon the acquisition of skills. Meanwhile, many instructors would still be loath to make such changes in their courses or in their teaching methods so that to rely exclusively on content-based instructors for the inculcation of critical thinking skills would be to either put undue pressure upon instructors or to risk failing students.

Teaching critical thinking skills also requires considerable time in its own right which is one reason that responsible faculty hesitate to add that responsiblity to the one of imparting content. Even where the skills involved are closely related to the subject matter, it is still true that time must be taken to explain and demonstrate the necessary cognitive skills, to monitor repeated practice at ever-increasing levels of difficulty, to provide frequent and detailed feedback, and to share the results of these efforts.

Upon closer examination, "content-based" vs. "skill-based" turns out to be too simple a dichotomy. When the choice of either mode is made to the exclusion of the other, too much is sacrificed. It matters less which option is chosen than that the curriculum be designed to permit both explicit instruction in the skills and regular exercise of the those skills in practice upon applications in a variety of "real" domains. These conditions are not automatically met in a traditional skill-based course, nor automatically excluded from a content-based one. As long as both conditions <u>are</u> met, on the other hand, the choice of delivery mode can be left simply to what is feasible in a given situation, what instructors are able and willing to do, how schedules and workloads are figured and what students are willing to spend time and money on, etc.

Curriculum Planning for Critical Thinking: Promising Options

A number of promising ways of structuring courses for the teaching critical thinking skills exist or are emerging that permit both specific attention to the particular demands of instruction in a skill and the immediate application of these skills in "intelligent acts" typical of a given field. Among these are:

a) **Regular Content-Based Course:** The content-based instructor not only requires course work that calls for critical thinking but specifically analyzes what students are failing to do when they are unable to meet requirements and provides them instruction and coaching in at least those thinking skills immediatedly needed.

b) **Skill-Oriented Content-Based Course:** Perhaps in an introductory course committed primarily to content, the instructor nonetheless identifies and builds into the syllabus time for explicit instruction (and regular practice and coaching) in those critical thinking skills that will be most essential to success in this and subsequent courses in the field.

c) **Less-Intensive Content-Based Course:** Skill becomes the main objective of the course, content remaining to provide immediate practice as well as substantive learning, but coverage sacrificed wherever necessary (just as, in other courses, skill development is sacrificed as needed to assure content coverage). There is no need to move on until demonstration of the essential competencies is achieved. (Such an approach may mean covering in two semesters what might otherwise be covered in one.)

d) **Skill-Oriented Supplementary Instruction:** Study sections are provided weekly in conjunction with a regular course, sections whose immediate objective is to improve term papers, test scores etc., but whose methods provide for explicit instruction and coaching in critical thinking skills. (See Attachment)

e) **Tandem Courses:** Two courses, one taught by a content-based instructor (e.g. a history teacher) and one by a skill-based instructor (e.g. a writing teacher), are provided to one group of students by teachers who plan their courses to support each others objectives and to assure both skill-oriented assignments (e.g. in history) and content-oriented practice (e.g. in English).

f) **Content-Oriented Skill-Based Course:** The main assignments in a reading or writing or college survival course come from homework assigned in various content-based courses being taken concurrently by the students.

g) **Transfer-Oriented Skill-Based Course:** Courses traditionally thought to strengthen thinking skills (logic, geometry, Latin, English, German, computer-science, science labs) are taught with an explicit effort to identify the generic thinking skills involved and to discuss their possible applications in quite different environments (perhaps with guest speakers).

Teaching Critical Thinking: An Approach that Works

Students who come into a class uncertain of their abilities need first of all to gain confidence. If the course is structured to identify and take advantage of the critical thinking skills they already possss and then to build upon that with steps small enough that success is

likely each time, and if the course does not move faster than most students are able to stay with it, confidence grows. With confidence comes courage.

One way to shift the focus of students onto process and to introduce the notion of critical thinking skills while starting students off with greater confidence, is to give them the opportunity to do something they already know how to do. An instructor could, for example, invite students to discuss the purchase of a car or to compare rock and roll groups or to organize a shopping list or to choose someone they would want to have as a boss. During the class discussion, the instructor could analyse what they are doing and show students the critical thinking skills they already possess and use every day. The instructor could then show how these newly identified skills could be applied to assignments in the course.

Thereafter, when the instructor gives an assignment, he could walk through an example, explicitly describing the kinds of critical thinking skills that are appropriate, trying out and assessing various problem-solving strategies and encouraging suggestions from students. Students might then first attempt to do such assignments in groups, talking out their thinking as they go and calling on the instructor with questions as needed. (They might be encouraged to offer the instructor not only questions but their best guess as to an approach whenever they call for help).

Then when students bring their assignments back to class, they could once again work in small groups to analyse what was done and why, with an effort to identify promising strategies--even where the final result doesn't fully work out.

Students working in groups and eventually on their own should **devise problems and questions for other groups and each other. The better problems and questions should be identified by the students under the instructors guidance and the reasons why they are better discussed and then turned into general principles.** Eventually such student-generated material should provide the basis for actual examinations.

It has often been the experience of instructors who use such techniques that *what is lost in coverage is gained in leverage*. Thus the very slow progress at the beginning of a course is made up for in the end as students begin to move ahead quickly (that is, just at the point when courses taught the usual way often bog down as students earlier uncertainties catch up with them.)

Teaching Critical Thinking: Conditions of Success

Stress on Process:

The most distinctive thing about teaching critical thinking skills is that it involves at least a partial shift in the focus of the course from content to an on-going concern with process, or to what has been termed "meta-cognition". And process involves not only skill, but also

self-tolerance, courage and persistence. Instruction in such things benefits from specific information regarding how the brain works, tied in with explicit discussion of the process the instructor, students, and experts go through to accomplish objectives in given fields. It also benefits from frequent acknowledgement of the difficulty of what is being attempted and of the feelings of uncertainty, frustration, stupidity, fear, elation, relief, etc that normally accompany such efforts.

Coaching Techniques

Beyond the specification of objectives and the concern with process which can be incorporated into any course without undue sacrifice of time, there are also specific techniques essential to the coaching of a skill that obviously do take time. These coaching techniques supportive of the development of critical thinking skills include:

a) **Identification and sequencing of skills**: Complex competencies should be broken down into identifiable skills, carefully sequenced in level of difficulty. It is important that the initial work, the terminology used to explain it, and the feedback given to it not be intimidating. Frequent, early success builds the courage needed for later difficulties.

b) **Modeling the proper exercise of such skills:** Students need to actually see people struggling with ideas as when an instructor talks out an analysis, using a chalk board, or when other students, in problem-solving pairs, explain their approaches to solving problems. They also need to see correctly finished products, e.g. blue-book exams or term-papers with analysis and comment.

c) **Incorporation of skills emphasis in regular assignments:** It is not enough simply to show students effective techniques on a take-it or leave-it basis. The focus of their work in the class must become partly one of tackling the difficult and sometimes frightening on a regular basis. Some assignments should be designed specifically to increase critical thinking skills, with feedback focussed not just upon the outcomes, put upon the skills and strategies which contributed to those outcomes.

d) **Closely monitored practice**: Someone needs to go over what students have done and help them identify strengths and weaknesses and talk out the process whereby they completed the work; fellow-students, instructional aides or tutors, or the instructor can do this. This extra help is the most expensive, yet one of the most crucial, parts of any effort to strengthen critical thinking skills; without it, the effort is sorely handicapped. Supplementary instruction is a way to achieve this close monitoring without sacrificing course coverage or instructional time. (See attached article, "Breaking the Attrition Cycle")

d) **Use of skills in a situation calling for intelligent action:** The skills should be applied as quickly as possible to tasks that students recognize as "real" such as taking an examination in a content-based course.

e) **Analysis of how well the necessary skills were employed:** Formal assessment of students progress in their use of the skills should be accomplished primarily be analyzing the process they have gone through in employing these skills in "real" situations.

Planning for Transfer

Transfer must not be left to chance. Wherever critical thinking skills are taught, whether in a skill-based or content-based course, an explicit effort should be made to facilitate the transfer of these skills. This effort is so essential because many students, lacking experience and self-confidence, will not readily make such transfers on their own. Yet without such transfers the generality of critical thinking skills and the great power they provide for handling a lifetime of new sitations is lost.

Transfer is facilitated partly just by telling students that it is possible, and offering a few examples, so that they expect and start looking for opportunities that present themselves in other courses, etc. A more extended version of this idea would be to have guest lecturers from other content-areas. For example, *a geology instructor who had been teaching the research methods peculiar to historical geology might invite in a history teacher or a linguistics teacher to explore the similarities and differences in the methodologies of their respective fields*. A key point in the ensuing discussion should be the universality of the value of systematic gathering and sifting of evidence, regardless of the field. The geology teacher might accompany this guest lecture, or follow it up, with one from an occupational specialist--say an automobile repair instructor--who could explain how the same patient, systematic mind-set useful in solving a problem in geology is also necessary for isolating an electrical problem in a car.

Committment

Teaching critical thinking skills and facilitating their transfer is part of the educational effort public concern is calling for. But if the effort stops there, the whole point is missed. For once again it is not skill alone that the public wants; it is the exercise of that skill, wherever appropriate. And the exercise of critical thinking is as much a matter of disposition as of skill. It is a matter of courage in the face of uncertainty, of persistence in the midst of difficulty, of patience in the face of complexity. And it is, above all, the willingess--when truth is importantly at stake--to sacrifice security, efficiency, (and sometimes even loyalty) in its service.

Obvious as this point is, once made, it is in danger of proving a mere platitude if its implications are not closely examined. At its root, insistence upon critical thinking in the fullest sense is insistence upon jeopardy for student and teacher alike.

> **"Critical thinking is reflexive. It is not reasoning from A to B; it is reasoning about "Why A?" and "Why B?" The reflexive character of critical thinking places unusual demands on teachers who would teach critical thinking....People tend to be wary of critical thinking and made uncomfortable by it. The critical thinker may choose, on reflection, not to solve the math problem, may even choose not to teach it!**
>
> **(Unpublished Manuscript, "Teaching Critical Thinking"by Beatrice K. Nelson)**

Our native tongue appears to us at the beinning as a purely transparent window on the real world. Ony later on, in encountering other tongues and other usages do we come to a more reflective self-consciousness about our own symbolic representations. Extended further, such self-consciousness turns sytematically critical, forcing a theoretical wedge between ourselves and our own representations...we thus acquire a reflective distance...

(p. 20, Of Human Potential, by Israel Scheffler)

If it is to be authentic, the requirement for "critical thinking" in a course cannot only affect the objectives of the course, its content, texts, assignments, and evaluation modes. It must also, most importantly, affect the style and methods of instruction and the atmosphere of the class. Care in reasoning matters little if the products of reasoning are not taken seriously in the class; if problems are set only as exercises. And if care is taught only in connection with exercises and never in connection with real beliefs, deeply felt, then the likelihood of the transfer of critical thinking skills to any context where they really matter is greatly reduced. On the other hand, if the critical thinking going on in a classroom is to be authentic, then it means that the statements of the teacher and of the text, and the assumptions and values inherent in the discipline or field under study must all be open to scrutiny, should question arise. It may also mean that the teacher should explicitly and consciously raise such fundamental questions and be prepared to seriously entertain any resulting challenges.

Nor must this questioning in its turn be permitted to become but an empty exercise. The object is not the production of knee-jerk scepticism. Questioning is only part of critical thinking. Understanding and being able to assess evidence, knowing when to act on partial evidence, and recognizing where values or fundamental principles must simply be accepted as starting points are also crucial aspects of the full exercise of critical thinking. In the end, the educational objective is for students to arrive at better answers--not to refuse answers at all. It is for them to take more responsibility for the answers they accept--not to avoid taking stands at all.

Desire here blossoms into committment, perseverance, loyalty--a kind of love of the project embarked on, with which one identifies oneself and which helps shape one's self-respect. Beyond realistic hope, not always available, lies faith; and love of the goal may inspire the courage to conquer even realistic fears. It is not only in the realm of moral principle, thus, that fear and love, courage and respect, have a role to play, but throughout the sphere of action their relevance is evident. Hedged about by constraints on available options, by limitations of capability, and by the uncertainty of even the best-available foresight, human choice proceeds nevertheless to stake out paths in the jungle of possibilities, building habitations of varied structure and adornment to house its loves and works.

(p. 33, Of Human Potential, Israel Scheffler)

CHART: CRITICAL THINKING SKILLS

On the next page is a chart showing the five main components of intelligent action and attempting to distinguish which aspects of each of these components is generic and transferable, hence a "critical thinking skill", which are are attitudes, and which are domain-specific (i.e. skills or knowledge or attitudes specific to a given domain or field of human endeavor and hence dependent upon specific experience with that field). **It may be useful in defining objectives for a course or in designing situations that test these abilities.**

On the two pages following is a double-chart organizing intelligent actions in the order of difficulty. Moving from top to bottom, it becomes more difficult to explain to students what is required and more threatening to students to carry them out. For the most part, those actions called for toward the bottom of the page presuppose the ability to do those occurring earlier on the page.

The two sides of the double-chart attempt to show the roughly parallel development in hands-on and/or technical tasks, on the one hand, and the more academic, verbal tasks on the other. **These charts may be useful in identifying and sequencing content-based tasks that call for critical thinking skills at increasing levels of difficulty.** While transfer horizontally across these two classes of activities, on the double chart, even at the same level, rarely occurs spontaneously, there is some evidence that explicit efforts to bring about such transfers can reap marked benefits to students.

One such effort to encourage transfer of critical thinking skills across the split between "verbal" and "visual" follow the chart. is an effort to use the visualizing, graphing techniques typical of "problem-solving" to carry out the essentially verbal task of writing an answer to an essay examination.

SOME THINKING SKILLS CRITICAL TO COMPREHENSION, COMMUNICATION, & PROBLEM-SOLVING

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Components of Intelligent Acts	Generic Thinking Skills	Attitudes Critical to Thinking	Domain-Specific Thinking Skills
1. PROBLEM-POSING Perceiving and defining a problem (or potential). Asking a fruitful question Defining an effective theme	•Understanding what a problem or a theme is, in general, and having some schemata or search strategies for anticipating or discerning problems or developing a theme •Ability to sift through multiple variables and "put one's finger on the real problem" or the "real point" •Ability to shift perspective, to re-define problem or theme from different perspectives •Ability to articulate a problem or theme in different terms	•Initiative •Habit of "scanning", of looking out for problems or significance •Both caution and confidence in setting aside other variables or themes to focus on the one more promising •Tolerance for "cognitive dissonance" and uncertainty •Recognition that problems must often be redefined, or ideas reworked, before a solution or a structure can be found •Overriding desire to find the best solution or structure	•Knowledge of the types of problems or issues constitutive of this discipline or familiarity with the types of problems that typically show up in this field or situation. •Understanding of the vocabulary peculiar to this field and of the range of terminology that can be used to define problems or state ideas that will be comprehensible to others in the field •Experience with successfully reformulating problems/ideas in the past; familiarity with the different viewpoints in the field
2. INQUIRY Determining what information is necessary and obtaining it	•Understanding when its necessary to ask each of the following questions •Ability to evaluate the distinct kinds of evidence for each: *a. What do you mean?* *b. How do you know?* *c. So What?*	•Disposition to seek answers before acting and to check the validity of crucial information where it may be suspect •Willingess to take responsibility for the truth of one's claims •Honesty	•Understanding of the modes of inquiry constitutive of a discipline or of the techniques for finding out used in a field •Skill in following these modes or using these techniques
3. STANDARDS Understanding what is at stake in the situation, what are the objectives, or the standards of the endeavor	•Understanding standards of relevance, clarity, evidence, logical validity, coherence, proportion, economy, utility, fairness •Understanding of when and how these standards apply •Techniques for testing when these standards have been met	•Appreciation of what it means to meet standards •Willingness to subject one's ideas or efforts to critical scrutiny and to modify them in light of what is found out, in order to meet standards of truth, justice, caring, beauty, effectiveness and efficiency	•Understanding of the standards constitutive of a discipline, or the objectives constitutive of a field •Experience applying these standards to actual situations; •Judgement regarding the relative importance of standards and when they may be safely set aside
4. CREATIVE THINKING Generating alternatives	•Ability to "break a mind-set" •Familiarity with strategies and schemata that could be varied to fit new situations •Brainstorming & insight-generating techniques	•Tolerance for uncertainty •Playfulness •Courage •Patience and persistence •Understanding and respect for one's own creative processes •Capacity to work with others	•Familiarity with all of the usual alternatives available in the field •Experience solving a wide array of problems and generating additional alternatives when the usual ones wouldn't work
5. REASONING Accepting a conclusion; making a plausible decision for sound reasons Assessing one's own work correctly	*Intelligent acts require general cognitive skills, the disposition to use these skills, and knowledge peculiar to a given domain. "Critical thinking" can be viewed as covering all of these general cognitive skills or as limited to a special sub-set (the evaluative). The ability of someone to "think critically" is not just the sum of these skills but how they are applied. Assessment of critical thinking skills must be based upon a careful analysis of how they were used, with the relevant "domain-specific" knowledge, in such actual applications as grades in content-based courses or on-the-job effectiveness.*		

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Tasks Calling for Critical Thinking Skills

EXPOSITION

Primarily verbal skills essential to success in the liberal arts, professions, management, public policy, and the making of complex personal decisions

	Levels of Teaching	Methods of Teaching and Assessing	Examples of Assignments
Not Critical Thinking	**Answering Questions** Answering "what", "when", "where", "who" and "how" questions; giving definitions; listing, summarizing or describing information from the course; completing a form on the job.	Go over the test and notes from your own lectures in class, asking aloud and getting answers to the question: "What question is answered here?" The accuracy and types of questions asked in response is an indicator of comprehension.	Have students look at their notes or texts and generate their own questions by asking themselves "To what question is this passage an answer?" Initally they will typically produce primarily informational questions.
Critical Thinking	Using information presented in the course, or data already available on the job, to appropriately answer questions posed regarding "Why" or questions that require analysis, synthesis, comparison, evaluation, or justification	When a student generates a "why" question, take particular note and get students discussing what questions are the most powerful and why. Explain the structure of analytical questions using familiar material (and visualizations. See following pages for some examples.)	In quizzes, use student-generated questions and pose analytical questions,explaining ahead of time how answers to such questions can be structured. (Requiring them to use visual analogues for each of the usual essay questions are helpful. (See examples on back of next page)
	Asking Questions Obtaining and then analysing, comparing evaluating, synthesizing information and ideas not presented in the course or already available on the job. Material from other classes can be used ito let students experience the transferability of thinking skills.	Once students have become comfortable working with more powerful questions and answering them from material already available in the class, similar questions can be posed that require finding additional material on one's own using techniques explained in class.	Use of structures (see next chart) will generate many questions that go beyond the material. Set-breaking exercises (see DeBono) brainstorming techniques and other "creative thinking" exercises can be combined with self-criticism techniques (See below) for specific assignments
	Questioning Answers Critically assessing the material in the course, or material generated by oneself. (This should be taught partly to engender a healthy scepticism, but primarily as the parallel process to creativity: insight vs. verification, "right-brain" vs. "left-brain"; global vs.linear; intuition vs. analysis)	Material presented in the text can be analyzed to determine which of the inquiry techniques (presented above) generated it. Instructor may criticize the text and may carefully go over the criticisms to point out relevant criteria. *Above all, the instructor must subject his own views to scrutiny and be willing to modify them publicly during a discussion*	Students may be asked to read criticisms of their text or readings that conflict with it. After criticism has been modelled and analyzed by the instructor, or generated in class discussions, students could attempt their own carefully argued criticism, based where possible upon their own experience. *This kind of learning is threatening and is best internalized in a supportive class*
	Questioning Questions Rethinking the frame of reference, the underlying assumptions in the material taught, with an emphasis on conceptual, normative, and theoretical analysis	Comparisons of divergent views or theoretical anomolies may be presented, then discussed, with the instructor actively posing questions that lead students to perceive that the differences in viewpoint stem from differences in terminology or even in the questions being answered. Instructor may model reformulating a problem and then explain that process.	To criticize ones own work or to have a frame of reference questioned or shifted is disturbing and is thus often resisted. Important but not intractable emotion-laden topics are best assigned initially until the realization of the universality of reinterpretation and redefinition begins to dawn, when more threatening topics might be attempt-ed. (In short, debating "abortion" is NOT the place to start)

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Tasks Calling for Critical Thinking Skills

PROBLEM SOLVING

Primarily spatial, reasoning, and quantitative skills essential to the performing and other arts and to householding, various occupations, technical fields, research and management.

Level to be Emphasized in Teaching	Methods of Teaching and Assessing	Examples of Assignments	
Solving Problems Posed Solving problems posed by others using a given formula or a step by step procedure (including word problems with procedure given)	Consider not using a textbook, at least initially, and having students take complete notes with full written explanations, diagrams and charts they draw themselves, and their own marginal comments.	Have students make up their own problems and solve them, or each others. Have them first read the problem sets in their texts to see what they understand or can guess-- then read the text to see if they are right!	*Not Critical Thinkin*
Solving problems set by others by first formulating the problem more precisely and then selecting from among solutions of proven effectiveness (including puzzles and word problems other than above)	Have students set word problems or problem situations for you and model solving them, slowly talking out possible approaches, and thinking aloud about why you reject some approaches and pursue others.	Have students work in pairs and talk aloud their approach to solving problems, stopping each other when a step is skipped or wrong; have them use pictures and/or write out their thinking (see attached & Whimbey).	*Critical Thinkin*
Posing Problems On the basis of experience and understanding of a given set of objectives, standards, etc., perceiving or anticipating problems (or potentials), defining and acting to solve the problem (or realize the potential) by known solutions, or by trial and error.	Analyse cases in class. Observe students solving problems or carrying out complex processes, in hands-on situations, and later have them analyse what they did and why. From these analyses, illustrate principles and draw out rules of thumb appropriate to the field.	Have them observe and evaluate situations, act, and analyze their own actions. Have them write up "lessons learned" from experience (as some companies reward employees for doing).	
Posing New Solutions Generating new ideas, approaches, solutions, or techniques; making new uses or new combinations of old ideas; risking solutions of unknown value.	Specifically explain and practice brainstorming and other "right-brained" or "creative thinking" techniques intended to help students break through a mindset. Encourage "meta-cognition", i.e. watching how one's own cognitive processes work and learning to work with them and to appreciate the wide diversity of effective styles of problem solving. Teach techniques for cooperative problem-solving.	Require students to deal with situations novel enough that the solutions they are accustomed to using won't work reliably thus forcing joint efforts, risk-taking and persistence. Require them to explicitly try out techniques taught and to discuss, and possibly record, the processes they went through and to share such records with other students looking for ideas.	
Redefining Problems Recognizing when the way the problem is posed is getting in the way of a solution, or is not the "real" problem. Redefining what counts as a solution or the very terms in which the problem is described.	Same as above. Also provide historical and other examples of cases where viewing the problems differently was the first step to solving them. Model formulating the "problem" in many different ways. When explaining different theories, show how each would view the same problem differently and what would be gained thereby.	Require students to take the same "problem" and define it in several different ways, perhaps in each of the ways suggested by different theories discussed in class. Reward risk; i.e. reward students for redefining the problem even when they sometimes are less effective because of having tried to apply something new learned in class or to have done something more difficult.	

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T-Formations

Comparison/Contrast

Typical Essay Question:
"Explain the similarities and differences betweencontemporary Britain and America"

England	*America*
Same language	
Parliament	*Congress*
Royal family	*No inherited offices*
Import most food	*Grow most food*
Both democracies	
Both world powers	
Both industrialized	
Etc.	

Pro/Con

Typical Essay Question:
"Discuss the issue of immigration"

Limiting Immigration: +	-
Preserves jobs for Americans	*Keeps cost of labor artificially high*
Makes it possible to serve the needy already here	*Keeps out the needy and the endangered*
Country can only hold so many	*Almost all Americans were once foreigners*
Family members get priority	*Separates families*
Etc.	

Comparison Grids

Typical Essay Question:
"Discuss the Italian, French, and English Renaissance"

	Italy	*France*	*England*
Dates?			
Center(s)?			
Political Leaders?			
Key Events?			
Key Discoveries?			
Scientists/Inventors?			
Writers?			
Artists?			
Art Works?			
Philosophers?			

If you were setting a question like this for yourself ahead of time while studying for your exam, you could make up the list of topics (left hand column) from your comments in the margins of your class notes and the sub-headings in your textbooks. Answers in the boxes could be page numbers or lecture dates. (Avoid questions that would have a simple yes or no in the boxes)

"EXAMINATION VERBS" FOR ESSAY TESTS

VERB	POSSIBLE FORMS
DESCRIBE: What? When? Where? Who?	LIST PICTURE DIAGRAM
DEFINE:	VENN DIAGRAM TREE
GIVE AN EXAMPLE OF	PICTURE
LIST, CLASSIFY	LIST TREE
COMPARE/CONTRAST	"T" FORMATION (C/C) C/C GRID
EXPLAIN THE RELATIONSHIP BETWEEN ANALYZE 1. List key factors 2. Determine if relationship is:	OUTLINE VENN DIAGRAMS TREE
Categorical (including Argumentation)	
Sequential	
Process	FLOW CHART
Chronological	DATE LINE
Causal	CAUSAL ARROW
Spatial	
3. Choose appropriate form	
TRACE THE DEVELOPMENT OF, SHOW WHY, WHY?, EXPLAIN THE CAUSES OF, GIVE REASONS WHY SUCH &SSUCH HAPPENED	CAUSAL ARROW SYSTEMS FLOW
EXPLAIN THE PROCESS OF (HOW TO, ETC.)	FLOW CHART CYCLE LIST STEPS
EXPLAIN THE REASONS FOR, JUSTIFY, SHOW THAT, PROVE, etc.	"T"FORMATION (+/-) VENN DIAGRAMS DEFINITIONS LIST OF REASONS
EVALUATE, CRITICIZE, INTERPRET	LIST OF TOPICS

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